

Racecar Engineering
The Designers
Bruce Ashmore

By: Ian Wagstaff

Bruce Ashmore used to have a theory that Lola would win the Indianapolis 500 every 12 years. Certainly from the mid-1960s to the first of Arie Luyendyk's victories that held true with the company leading the field in 1966, 1978 and 1990. The T90/00 that achieved the last of these was arguably Ashmore's finest work.

"In terms of my favourite designs that is the one that sticks out the most," he recalls. "It won the pole and the 500 at Indianapolis with Luyendyk and the championship with Al Unser Jnr. but it was more than just that. It was a major departure from the 1989 model, the T89/00. I had worked on the Indy cars from 1983 and taken over the project in 1987. The T88/00 was the first one for which I was the chief designer. We won some races with that but everything revolved around Indy at that time so you compromised on all the other tracks to make sure you were fast there. We had put everything into lowering the centre of gravity and making it stiffer and more reliable but we were slower than the Penskes.

"The time carried out in the wind tunnel was increased for the 1989 car. We lowered the centre of gravity further and made sure that there was less frictional drag by working on the transmission, the wheel bearings and the uprights. It was a little bit quicker than the previous year but the Penskes had moved up another step. So I then put everything into aerodynamics. The 1990 car had the minimum chassis size – the side pods were minimum height and maximum width. The wheelbase was stretched to give more room for the components. The turbo was moved so that the engine cover was lower. I took out all the adjustment for the suspension geometry as this had been affecting the aerodynamics. It was a 100 per cent aerodynamic project. The Indy 500 is fast so I decided we had to have the lowest drag and the most downforce."

States Ashmore, "My driving force has always been aerodynamics. I would compromise anything for this. I would not worry about such as raising the centre of gravity or increasing the weight." You can see where the influence comes from. The last year of his apprenticeship at Lola, 1980, was spent in the drawing office. The Lotus 79 had proved that ground effects were the way to go and

“aerodynamics had become the big thing.” Lola had just started to make use of the quarter scale wind tunnel at Imperial College, London.

“Another car that sticks out in my mind was the T640E Formula Ford that won the Townsend Thoresen championship and Formula Ford Festival driven by Julian Bailey.” This was designed by Andrew Thorby. However, Ashmore also worked on it, taking over the project and carrying out the development. “The Van Diemens that had been winning before were very boxy but we started to smooth things out. We used oval tubes for the wishbones and all the bodywork underneath the gearbox was smooth. We could not afford aerofoil tubes so we squashed the mild steel round tubes into an aerofoil shape. There were little winglets at that back and we stretched every shape that could be into an aerofoil. The car never went into a wind tunnel but we made everything as smooth as possible. We just knew that was how the car should look.”

The T640 American version won over there driven by Michael Andretti. However, it is another Formula Ford design that Ashmore perhaps remembers more as this was to feature ground effects. The T740 would have had side mounted radiators with an underwing. A couple of week’s wind tunnel testing was carried out at Imperial College but “we had got so heavily into Indy cars that it never ran. I reckon that it would have been a really good car because we tested the level of downforce that it would have had by adding illegal test parts on the T642 and it was fast.” Lola looked into the possibility of the T740 being built by outside contractors but it never happened.

Ashmore’s main theme can also be seen in his 1985 T594 Sports 2000. “Again the emphasis was on aerodynamics with more of a tear drop shape and the car was a success. Our previous Sport 2000 had been a very boxy little car. The T594 had the two philosophies that I like.” In addition to the aerodynamic emphasis “the chassis was as stiff as we could make it.”

There are other themes that have occurred in Ashmore’s designs. “I have never been a one for building super light cars,” he says. “I believe that racecars have first to finish the race, so mine have tended to be a bit overweight. Growing up in the customer car sector and never doing anything in Formula One taught me that you won by the numbers. If your cars finished and people liked them, then they would work to develop them. You would then win races, then the championship and more customers would buy them. Reliability was all-important.

“However, I did not worry so much about this with the 1990 Indy car. I had saved a lot of weight on the mechanical components but we had more bodywork so it was still a little bit overweight. The one-piece underwing was much stiffer and heavier. There were many gaps and leaks on the previous car so I designed this one so that all the suspension was on top of the underwing. It was such a big jump from the car before. It came out of the frustration of coming second at Indy all the time.” (Lola has managed this feat nine times.)

His 1991 design was more reliable. The suspension was moved for the 1992 version, thus making it easier to work on and there were some changes made for 1993 to meet new rules but all were essentially developments of the T90/00, which remains Ashmore’s favourite.

And the other end of the scale? Ashmore recalls that, during Lola’s early days of wind tunnel use, “we did not really know if reducing the drag or adding downforce was going to make a car go faster so we did a lot of testing. We often misled ourselves. The wind tunnels and the models weren’t that good. There were a lot of cars at that time that just did not work and we built some at Lola. The 1983 Indy T700 was a real ‘dog’ when we first took it out. However, by the end of the year we had won at Elkhart Lake, which we achieved mainly by increasing the stiffness of the chassis and adding sealed and molded carbon underwings to replace the old ones with gaps and leaks that we had at Indy.”

In the late 1980s Ashmore began to realise that to design a better car you had to design a better wind tunnel. “We had started using wind tunnels that were left over from World War Two aircraft design.” Lola was now using the Cranfield tunnel where it owned the rolling road and electronics system. By the end of 1989 the Lola team could, recalls Ashmore, rely on the tunnel “to tell the truth. However, it was still not a fantastic instrument and you had to keep an eye on the electronics, as every now and again you would get a rogue run. Now everybody uses wind tunnels.”

Another car that comes to mind as less than successful was the 1986 Indy T86/00. “I was assistant designer on that car to Nigel Bennett. It caught us both out. There had been a big rule change. The 1985 car had been a pretty good one. We then spent a lot of time with the regulations people and we thought we were on top of all the changes, which had been brought in to slow the cars down. Then we looked at the opposition and we were so far behind. The car did not have enough downforce. It was big. It was heavy. That car drove it home to me that aerodynamics were so important.”

Another of Ashmore's *leit motifs* is to try and make a car with a minimum number of components. Wishbones, for instance, are generally non-handed. The front top wishbone on the left hand side is the same as the wishbone on the right hand side. "I will force the design into being like that. I think this came from the time of drawing by hand. I also started in a machine shop so I knew how hard it was to set up and make a component. The fewer components the shorter time that you needed to make the car or the fewer people that you needed to do so. You could get it on the track before anyone else and start testing it.

"I remember back to the days when Penske and Lolas used to line up together on the front row of the grid at Indianapolis with almost exactly the same speeds. One year I caught Roger Penske examining our car. He looked down at the top wishbone and the brackets that held it onto the tub. He could see each bracket was the same piece and the lower wishbone brackets were similar to the top. He shook his head and then looked at the complexity of his car. Every wishbone bracket was different and the bolts were in at different angles. He just looked over at me and smiled."

When designing a car the first thing that concerns Ashmore is layout - "where," as he says "everything goes."

"You are usually racing against somebody else. Look at their layouts, their history, where did they get where they are? Think in broad strokes – where do all the bits fit on the cars?"

"The next thought is that if they are doing things like that, where can I move things around and get an advantage? When I was growing up the cars were changing, going from a wedge shape and getting into ground effects. We were moving components like turbochargers, radiators and radiator ducts to squeeze in tunnels and bigger wings.

"I then try to stretch something such as a longer wheelbase or a wider track. It is always to get more downforce and maybe less drag. I have to ask why nobody else has gone that long, that narrow, that big or that small. When I came into designing cars regulations were already in place governing overall width and length. However, there were not minimum tracks or maximum wheelbase regulations. It is the same today, only the numbers are smaller.

“I write all the regulations down and look at where the minimums and maximums are. When you are an engineer, everything you do is in tolerances. It does not matter whether it is plus or minus half a thou or plus or minus five inches. So, you put down all the boxes that you are allowed to go into, reckon on what would be different to what everybody else has done and then ask can you make it work? Wheelbases and body width should be maximums, chassis need to be minimums. Push everything as far as you can. That’s the first thing.”

Ashmore points out that he likes sketching, usually in 2D. “I’m not that good at 3D sketching. Eric Broadley was fantastic. We would have a big sheet of paper on the desk and over a period of two or three days a 3D dimensional car would appear. I could think in 3D but I could not really express it on paper. However, those 3D sketches did not generally work. They would be very nice drawings but the car would often not lay out. I therefore found that my job was to do the 2D sketches – plan views, side views, front views and probably three cross sections. I would have to force Eric’s 3D drawing into something that would lay out. I developed this as a technique.

“Now we are in the CAD era, I still do 2D using Expert CAD which is sold by Softech. This is basically an electronic drawing board. You lay out with construction lines, then draw the hard line; you can do radiuses and splines. It is as if you are working with a pencil and a drawing board but the great thing is you can copy and paste to try more ideas. You have to stay on top of the drawing though, to understand it in its entirety because it is up to you to make sure the views tie up and the part can be made. Solid model 3D then follows but I have other people to do this for me. There are those who tell me that they can design in 3D from the start but I don’t think you can do that, I design things that don’t exist yet where most 3D objects are already made in another form or come from a sketch or 2D layout.”

Like so many of his generation, Ashmore is not impressed by what he currently sees in motor racing “ I think the sport is in trouble right now. We have really got to change it. I don’t know who the marketing guys are trying to convince. Is it the public? They seem to be trying to persuade people that the car is not important.

“Every sanctioning body is falling into the same trap in which you eventually end up with a spec car. You start off with a number of constructors. Then the regulations get tighter and the team owners encourage this and eventually all the cars and engines are the same. Just the badges and decals are different. The sanctioning bodies try to manipulate photo finishes and many of the race fans are

happy with just that but there is a percentage that thinks the cars should be different to each other. They understand the rivalries and how one manufacture can improve its car so that it can move up the field. Spec racing drives away this not inconsiderable percent of the fan base. It's all become a marketing exercise.

“Despite this, in a spec series, it is the team that has the most money that wins. It is a big time/quality graph. The more time and money you apply so the quality goes up. It is far less likely that a small team, such as Players–Team Green was in 1995, will win the Indy 500 at present. Ashmore recalls that this had “the right combination of pieces, a really good driver in Jacques Villeneuve, a smart engineer in Tony Cicali, Goodyear tyres, Reynard chassis and Ford engine. It was not just a question of money. The team owners have now agreed to regulations that mean they will not be slow just because they have bought the wrong chassis or engine. They have removed some of the risky decision making but it's that risk that excites a large percentage of race fans.

“When the budgets were \$20 million they were easier to find than now they are \$6 million because there is nothing to sell. A technology sponsor becomes involved because it wants to develop but if there is nothing to develop there is nothing to sell it.” Ashmore believes “there is little to be innovative about in motor racing so designers are finding more motivation working in the road car sector. Those left in the sport are “all diddling around the same, small piece.”

He does not, though, simply pine for the past. He has ideas as to the direction in which motor racing should be heading, some of which can be seen in the projected USAC Gold Crown Championship for which he is responsible (see side bar). “I think that we need to open things up and that spec component racing is the way to go. You have a selection of parts – transmission, wheels, uprights, maybe event the chassis. You put these out to tender from various different manufacturers and then you join the dots up. You have freedom between the pieces and can move the components around.

“Once sponsors become interested you open up some of the areas. You let that be driven by something that needs to be developed for the road car world – perhaps an electric motor or a fuel. Right now an engine is a piston with con rods and a crank. It evolved that way when development was free but now you are told that it has to be this. There is never going to be anything different until you open up the regulations. However, we cannot afford to change the whole car in one go; we cannot afford to go back to where we used to be.”

This May, Ashmore could be found working enthusiastically on the Gold Crown project and engineering the RW Motorsports Silver Crown car of Shame Hmiel at the Indiana State Fairground. Perhaps it is significant that designer and engineer such as this should be finding more to motivate him at this level than if he were to be a few miles down the road at the Indianapolis Motor Speedway where once one of his designs drove into Victory Lane.

Bruce Ashmore is perhaps practising what he preaches in his role as series coordinator for the projected USAC Gold Crown Championship. In a world of stagnant ideas and wall-to-wall spec series, this could be something different. The series may be a phoenix rising from the ashes of the New Generation Silver Crown championship but it does have a certain appeal. Tradition is to be combined with a modern look but there is more to it than just that. Ashmore claims it may be the answer to those who bemoan the dominance of the overseas drivers in the IndyCarSeries in that its combination of road and oval courses could be the final rung of a ladder that takes American drivers to the Indianapolis 500.

The USAC Gold Crown Championship has already met with approval from potential car owners. At an initial meeting these guys unanimously agreed to a series roll out with the first cars due to appear later this year. Production of the cars will now commence with four different chassis constructors – Ashmore Design, Devin Race Cars, Riley Technologies and Rock Chassis. Testing and development will follow in 2010 with a 10-race programme scheduled for the year after.

The Gold Crown Championship is to be the Destination Series of USAC as well as being on the ladder system of open wheel racing for drivers aspiring to the Indy 500. Gold Crown construction will be tube-framed, front-engined, open-wheel cars specially designed to race on both superspeedways and road courses.

The design of the Gold Crown car combines a traditional front-engined configuration with modern styling, the work of Chevrolet designer Randy Wittine. The first sight of his creation came at last year's Performance Racing Industry show in Orlando where a model of the Chevrolet version was on display. The front body panel of each car will be sculptured to depict the engine used, thus encouraging manufacturer support from the fans. The engines will be the same

as those used for the Silver Crown series, currently 800+ hp, 358 cu inch, aluminium headed power plants from Chevrolet, Ford, Mopar and Toyota.

The sanctioning of quarter midgets by USAC has led to a growth in membership for the club, bucking the trends caused elsewhere by the economic downturn. The move will have a knock-on effect, strengthening midgets, strengthening Silver Crown and increasing the need and enthusiasm for the Gold Crown Championship. Teams and drivers will now be able to remain within the USAC family while working their way to the top and perhaps even the Indy 500 thus reviving the days when traditional US oval racing was the route to a ride at the Brickyard.

Coincidentally born five miles from Lola's factory, Bruce Ashmore graduated from Cambridge Technical University to join Eric Broadley's company. During a 17-year period there he progressed from apprentice to senior designer. He designed five of the company's Indy cars including the 1990 500 winning T90/00.

In 1993 Ashmore moved to Reynard to work on its Indy car project. Adrian Reynard described him as "a star designer who isn't 'starry'." Within two years, Reynard had overtaken Lola as the leading chassis supplier to CART. He moved to the USA to help establish Reynard North America and later the Auto Research Center. After two years with Players Forsythe Racing, he formed Indianapolis-based Ashmore Design at the end